

What is claimed is:

1. A method of confirming battery charge amount and degradation state, comprising the steps of:

measuring at a plurality of battery temperatures a cycle test battery in respect of one selected from battery open voltage, current and voltage during discharge, and current and voltage during charging at predetermined time intervals substantially until battery end of life;

using measured values to generate a determination table showing relationships between prescribed charge amounts and prescribed degradation states;

measuring a subject battery in respect of same said one selected from battery open voltage, current and voltage during discharge, and current and voltage during charging; and

comparing determination table values with a measured value of the subject battery to confirm present subject battery charge amount and degradation state in accordance with a determination table location of matching values.

2. A method of confirming battery charge amount and degradation state, comprising the steps of:

measuring at a plurality of battery temperatures a cycle test battery at predetermined time intervals substantially until battery end of life, using measurement values of at least two selected from battery open voltage, current and voltage during discharge, and current and voltage during charging;

using measured values to generate determination tables showing relationships in each case between prescribed charge amounts and prescribed degradation states;

measuring a subject battery in respect of said at least two selected from battery open voltage, current and voltage during discharge, and current and voltage during charging; and

comparing determination table values with each of measured values of the subject battery to confirm present subject battery charge amount and degradation state in accordance with determination table locations of matching values, and simultaneously using an incidence of appearance at determination table locations resulting from the measured values to estimate present subject battery charge amount and degradation state.

3. The method according to claim 1, in which a value of the battery open voltage is an average value of measurements made at fixed time intervals.

4. The method according to claim 2, in which a value of the battery open voltage is an average value of measurements made at fixed time intervals.

5. The method according to claim 1, in which the measurement of the voltage and current during discharge in a constant current discharge circuit comprises the steps of:

measuring battery voltage;

after discharge starts, measuring battery voltage a plurality of times at fixed time intervals;

measuring discharge current a plurality of times at fixed time intervals simultaneously with the step of measuring battery voltage a plurality of times; and

after terminating the discharge, measuring battery voltage a plurality of times at fixed time intervals.

6. The method according to claim 2, in which the measurement of the voltage and current during discharge in a constant current discharge circuit comprises the steps of:

measuring battery voltage;

after discharge starts, measuring battery voltage a plurality of times at fixed time intervals;

measuring discharge current a plurality of times at fixed time intervals simultaneously with the step of

measuring battery voltage a plurality of times; and  
after terminating the discharge, measuring battery  
voltage a plurality of times at fixed time intervals.

7. The method according to claim 1, in which the  
measurement of battery voltage and current during discharge,  
and a measurement of time, in a constant current, constant  
voltage discharge circuit comprise the steps of:

measuring battery voltage;  
subtracting a predetermined voltage from the measured  
battery voltage to set a constant voltage discharge value;  
measuring a time from a start of the discharge until  
the set constant voltage discharge value is attained;  
after the start of the discharge, measuring discharge  
current a plurality of times at fixed time intervals; and  
terminating the discharge.

8. The method according to claim 2, in which the  
measurement of battery voltage and current during discharge,  
and a measurement of time, in a constant current, constant  
voltage discharge circuit comprise the steps of:

measuring battery voltage;  
subtracting a predetermined voltage from the measured  
battery voltage to set a constant voltage discharge value;  
measuring a time from a start of the discharge until  
the set constant voltage discharge value is attained;  
after the start of the discharge, measuring discharge  
current a plurality of times at fixed time intervals; and  
terminating the discharge.

9. The method according to claim 1, in which the  
measurement of current and voltage during constant current  
charging comprises the steps of:

measuring battery voltage;  
after the step of measuring the battery voltage,  
starting the charging and measuring battery voltage when the  
charge current is changed a plurality of times at fixed time

intervals;

measuring the charge current when the charge current is changed a plurality of times at fixed time intervals; and terminating the charging.

10. The method according to claim 2, in which the measurement of current and voltage during constant current charging comprises the steps of:

measuring battery voltage;

after the step of measuring the battery voltage, starting the charging and measuring battery voltage when the charge current is changed a plurality of times at fixed time intervals;

measuring the charge current when the charge current is changed a plurality of times at fixed time intervals; and terminating the charging.

11. The method according to claim 1, in which the measurement of current and voltage, and a measurement of time, during constant current, constant voltage charging comprise the steps of:

measuring battery voltage;

adding a predetermined voltage to the measured battery voltage to set a constant voltage charging value;

starting the charging after setting the constant voltage charging value;

measuring a time at which the set constant voltage charging value is attained;

measuring the charge current a plurality of times at fixed time intervals; and

terminating the charging.

12. The method according to claim 2, in which the measurement of current and voltage, and a measurement of time, during constant current, constant voltage charging comprise the steps of:

measuring battery voltage;

adding a predetermined voltage to the measured battery voltage to set a constant voltage charging value;

starting the charging after setting the constant voltage charging value;

measuring a time at which the set constant voltage charging value is attained;

measuring the charge current a plurality of times at fixed time intervals; and

terminating the charging.

13. The method according to claim 1, in which ambient temperature during the step of measuring the cycle test battery to generate the determination table and during the step of measuring the subject battery, is measured a plurality of times at fixed time intervals.

14. The method according to claim 2, in which ambient temperature during the step of measuring the cycle test battery to generate the determination table and during the step of measuring the subject battery, is measured a plurality of times at fixed time intervals.

15. The method according to claim 3, in which ambient temperature during the step of measuring the cycle test battery to generate the determination table and during the step of measuring the subject battery, is measured a plurality of times at fixed time intervals.

16. The method according to claim 4, in which ambient temperature during the step of measuring the cycle test battery to generate the determination table and during the step of measuring the subject battery, is measured a plurality of times at fixed time intervals.

17. The method according to claim 5, in which ambient temperature during the step of measuring the cycle test battery to generate the determination table and during the

Step of measuring the subject battery, is measured a plurality of times at fixed time intervals.

18. The method according to claim 6, in which ambient temperature during the step of measuring the cycle test battery to generate the determination table and during the step of measuring the subject battery, is measured a plurality of times at fixed time intervals.

19. The method according to claim 7, in which ambient temperature during the step of measuring the cycle test battery to generate the determination table and during the step of measuring the subject battery, is measured a plurality of times at fixed time intervals.

20. The method according to claim 8, in which ambient temperature during the step of measuring the cycle test battery to generate the determination table and during the step of measuring the subject battery, is measured a plurality of times at fixed time intervals.

21. The method according to claim 9, in which ambient temperature during the step of measuring the cycle test battery to generate the determination table and during the step of measuring the subject battery, is measured a plurality of times at fixed time intervals.

22. The method according to claim 10, in which ambient temperature during the step of measuring the cycle test battery to generate the determination table and during the step of measuring the subject battery, is measured a plurality of times at fixed time intervals.

23. The method according to claim 11, in which ambient temperature during the step of measuring the cycle test battery to generate the determination table and during the step of measuring the subject battery, is measured a plurality

of times at fixed time intervals.

24. The method according to claim 12, in which ambient temperature during the step of measuring the cycle test battery to generate the determination table and during the step of measuring the subject battery, is measured a plurality of times at fixed time intervals.

25. In an apparatus that confirms battery charge amount and degradation state in which

values of a determination table showing relationships between prescribed charge amounts and prescribed degradation states based on measurements, at a plurality of battery temperatures, of a cycle test battery in respect of at least one selected from battery open voltage, current and voltage during discharge, and current and voltage during charging at predetermined time intervals substantially until battery end of life, and

a measured value of a subject battery in respect of the same one selected from battery open voltage, current and voltage during discharge, and current and voltage during charging,

are compared and present subject battery charge amount and degradation state are confirmed in accordance with a determination table location of matching values,

an apparatus for measuring open voltage in a battery, comprising at least:

a trigger signal circuit that generates a signal at fixed time intervals to operate a voltmeter;

a timer for setting the time intervals at which the trigger signal circuit generates the signal; and

a counter for pre-setting a number of times the trigger signal circuit generates the signal.

26. In an apparatus that confirms battery charge amount and degradation state in which

values of a determination table showing relationships between prescribed charge amounts and prescribed degradation states based on measurements, at a plurality of battery temperatures, of a cycle test battery in respect of at least one selected from battery open voltage, current and voltage during discharge, and current and voltage during charging at predetermined time intervals substantially until battery end of life, and

a measured value of a subject battery in respect of the same one selected from battery open voltage, current and voltage during discharge, and current and voltage during charging,

are compared and present subject battery charge amount and degradation state are confirmed in accordance with a determination table location of matching values,

an apparatus for measuring battery current and voltage during discharge, comprising at least:

a trigger signal circuit that generates a signal at fixed time intervals to operate a voltmeter and an ammeter;

a pulse-discharge generation circuit that discharges a battery at fixed time intervals;

a timer for setting time intervals at which the trigger signal circuit generates the signal and the pulse-discharge generation circuit discharges the battery; and

a counter for pre-setting a number of times the trigger signal circuit generates the signal and the pulse-discharge generation circuit discharges the battery.

27. In an apparatus that confirms battery charge amount and degradation state in which

values of a determination table showing relationships between prescribed charge amounts and prescribed degradation states based on measurements, at a plurality of battery temperatures, of a cycle test battery in respect of at least one selected from battery open voltage, current and voltage during discharge, and current and voltage during charging at predetermined time intervals substantially until battery

end of life, and

a measured value of a subject battery in respect of the same one selected from battery open voltage, current and voltage during discharge, and current and voltage during charging,

are compared and present subject battery charge amount and degradation state are confirmed in accordance with a determination table location of matching values,

an apparatus for measuring constant current, constant voltage discharge of a battery, comprising at least:

a trigger signal circuit that generates a signal at fixed time intervals to operate a voltmeter and an ammeter;

a constant current, constant voltage discharge circuit that discharges a battery at fixed time intervals;

a timer for setting time intervals at which the trigger signal circuit generates the signal and the constant current, constant voltage discharge circuit discharges the battery;

a counter for pre-setting a number of times the trigger signal circuit generates the signal and the constant current, constant voltage discharge circuit discharges the battery; and

a time-measurement circuit for measurement of time from start of discharge to a set fall in voltage.

28. In an apparatus that confirms battery charge amount and degradation state in which

values of a determination table showing relationships between prescribed charge amounts and prescribed degradation states based on measurements, at a plurality of battery temperatures, of a cycle test battery in respect of at least one selected from battery open voltage, current and voltage during discharge, and current and voltage during charging at predetermined time intervals substantially until battery end of life, and

a measured value of a subject battery in respect of the same one selected from battery open voltage, current and voltage during discharge, and current and voltage during

charging,

are compared and present subject battery charge amount and degradation state are confirmed in accordance with a determination table location of matching values,

an apparatus for measuring battery current and voltage during charging, comprising at least:

a trigger signal circuit that operates a voltmeter and an ammeter by generating a signal at fixed time intervals;

a constant current, constant voltage charging circuit that charges a battery at fixed time intervals;

a timer for setting time intervals at which the trigger signal circuit generates the signal and the constant current, constant voltage charging circuit charges the battery; and

a counter for pre-setting a number of times the trigger signal circuit generates the signal and the constant current, constant voltage charging circuit charges the battery.

29. In an apparatus that confirms battery charge amount and degradation state in which

values of a determination table showing relationships between prescribed charge amounts and prescribed degradation states based on measurements, at a plurality of battery temperatures, of a cycle test battery in respect of at least one selected from battery open voltage, current and voltage during discharge, and current and voltage during charging at predetermined time intervals substantially until battery end of life, and

a measured value of a subject battery in respect of the same one selected from battery open voltage, current and voltage during discharge, and current and voltage during charging,

are compared and present subject battery charge amount and degradation state are confirmed in accordance with a determination table location of matching values,

an apparatus for measuring constant current and constant voltage charging of a battery, comprising at least:

a time-measurement circuit for measurement of time from start of charging to a set rise in voltage;

a trigger signal circuit that generates a signal at fixed time intervals to operate a voltmeter, an ammeter and the time-measurement circuit;

a constant current, constant voltage charging circuit that charges a battery at fixed time intervals,

a timer for setting time intervals at which the trigger signal circuit generates the signal and the constant current, constant voltage charging circuit charges the battery, and

a counter for pre-setting a number of times the trigger signal circuit generates the signal and the constant current, constant voltage charging circuit charges the battery.

30. In an apparatus that confirms battery charge amount and degradation state in which

values of a determination table showing relationships between prescribed charge amounts and prescribed degradation states based on measurements, at a plurality of battery temperatures, of a cycle test battery in respect of at least one selected from battery open voltage, current and voltage during discharge, and current and voltage during charging at predetermined time intervals substantially until battery end of life, and

a measured value of a subject battery in respect of the same one selected from battery open voltage, current and voltage during discharge, and current and voltage during charging,

are compared and present subject battery charge amount and degradation state are confirmed in accordance with a determination table location of matching values,

a thermistor apparatus for measuring internal and surface temperatures of a battery located in proximity to the thermistor apparatus, comprising at least:

a trigger signal circuit that generates a signal at fixed time intervals to operate a resistance meter;

a timer for setting time intervals at which the trigger signal circuit generates the signal; and

a counter for pre-setting a number of times the trigger signal circuit generates the signal.

31. A storage medium in which are stored a program of the method according to claim 1 and the determination table according to said claim.

32. A storage medium in which are stored a program of the method according to claim 2 and the determination tables according to said claim.

33. A storage medium in which are stored a program of the method according to claim 3 and the determination table according to said claim.

34. A storage medium in which are stored a program of the method according to claim 4 and the determination tables according to said claim.

35. A storage medium in which are stored a program of the method according to claim 5 and the determination table according to said claim.

36. A storage medium in which are stored a program of the method according to claim 6 and the determination tables according to said claim.

37. A storage medium in which are stored a program of the method according to claim 7 and the determination table according to said claim.

38. A storage medium in which are stored a program of the method according to claim 8 and the determination tables according to said claim.

39. A storage medium in which are stored a program of the method according to claim 9 and the determination table according to said claim.
40. A storage medium in which are stored a program of the method according to claim 10 and the determination tables according to said claim.
41. A storage medium in which are stored a program of the method according to claim 11 and the determination table according to said claim.
42. A storage medium in which are stored a program of the method according to claim 12 and the determination tables according to said claim.
43. An information processing apparatus that downloads via the Internet a program of the method according to claim 1 and data for the determination table according to said claim.
44. An information processing apparatus that downloads via the Internet a program of the method according to claim 2 and data for the determination tables according to said claim.
45. An information processing apparatus that downloads via the Internet a program of the method according to claim 3 and data for the determination table according to said claim.
46. An information processing apparatus that downloads via the Internet a program of the method according to claim 4 and data for the determination tables according to said claim.

47. An information processing apparatus that downloads via the Internet a program of the method according to claim 5 and data for the determination table according to said claim.
48. An information processing apparatus that downloads via the Internet a program of the method according to claim 6 and data for the determination tables according to said claim.
49. An information processing apparatus that downloads via the Internet a program of the method according to claim 7 and data for the determination table according to said claim.
50. An information processing apparatus that downloads via the Internet a program of the method according to claim 8 and data for the determination tables according to said claim.
51. An information processing apparatus that downloads via the Internet a program of the method according to claim 9 and data for the determination table according to said claim.
52. An information processing apparatus that downloads via the Internet a program of the method according to claim 10 and data for the determination tables according to said claim.
53. An information processing apparatus that downloads via the Internet a program of the method according to claim 11 and data for the determination table according to said claim.
54. An information processing apparatus that downloads via the Internet a program of the method according to claim

12 and data for the determination tables according to said claim.

55. An information processing apparatus that includes a read-only memory in which are stored a program of the method according to claim 1 and data for the determination table according to said claim.

56. An information processing apparatus that includes a read-only memory in which are stored a program of the method according to claim 2 and data for the determination tables according to said claim.

57. An information processing apparatus that includes a read-only memory in which are stored a program of the method according to claim 3 and data for the determination table according to said claim.

58. An information processing apparatus that includes a read-only memory in which are stored a program of the method according to claim 4 and data for the determination tables according to said claim.

59. An information processing apparatus that includes a read-only memory in which are stored a program of the method according to claim 5 and data for the determination table according to said claim.

60. An information processing apparatus that includes a read-only memory in which are stored a program of the method according to claim 6 and data for the determination tables according to said claim.

61. An information processing apparatus that includes a read-only memory in which are stored a program of the method according to claim 7 and data for the determination table according to said claim.

62. An information processing apparatus that includes a read-only memory in which are stored a program of the method according to claim 8 and data for the determination tables according to said claim.
63. An information processing apparatus that includes a read-only memory in which are stored a program of the method according to claim 9 and data for the determination table according to said claim.
64. An information processing apparatus that includes a read-only memory in which are stored a program of the method according to claim 10 and data for the determination tables according to said claim.
65. An information processing apparatus that includes a read-only memory in which are stored a program of the method according to claim 11 and data for the determination table according to said claim.
66. An information processing apparatus that includes a read-only memory in which are stored a program of the method according to claim 12 and data for the determination tables according to said claim.
67. An electronic apparatus that includes a read-only memory in which are stored a program of the method according to claim 1 and data for the determination table according to said claim.
68. An electronic apparatus that includes a read-only memory in which are stored a program of the method according to claim 2 and data for the determination tables according to said claim.
69. An electronic apparatus that includes a read-only memory in which are stored a program of the method according

to claim 3 and data for the determination table according to said claim.

70. An electronic apparatus that includes a read-only memory in which are stored a program of the method according to claim 4 and data for the determination tables according to said claim.

71. An electronic apparatus that includes a read-only memory in which are stored a program of the method according to claim 5 and data for the determination table according to said claim.

72. An electronic apparatus that includes a read-only memory in which are stored a program of the method according to claim 6 and data for the determination tables according to said claim.

73. An electronic apparatus that includes a read-only memory in which are stored a program of the method according to claim 7 and data for the determination table according to said claim.

74. An electronic apparatus that includes a read-only memory in which are stored a program of the method according to claim 8 and data for the determination tables according to said claim.

75. An electronic apparatus that includes a read-only memory in which are stored a program of the method according to claim 9 and data for the determination table according to said claim.

76. An electronic apparatus that includes a read-only memory in which are stored a program of the method according to claim 10 and data for the determination tables according to said claim.

77. An electronic apparatus that includes a read-only memory in which are stored a program of the method according to claim 11 and data for the determination table according to said claim.

78. An electronic apparatus that includes a read-only memory in which are stored a program of the method according to claim 12 and data for the determination tables according to said claim.